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A Novel On-site Wavefront Correction Method for Ultimate Focusing of Hard X-Rays

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We developed precision fabrication and measurement methods to realize nano-focusing mirror devices for synchrotron radiation hard X-rays [1]-[5]. The fabricated KB mirrors were tested at the 1-km-long beamline (BL29-XUL) of SPring-8 and confirmed to provide nearly diffraction-limited focusing with a spot size less than 30 nm for 15 keV X-rays [6].

In a recent research project, we achieved 7 nm focusing of 20 keV X-rays by using Pt/C multilayer mirrors with an on-site wavefront phase measurement and correction method [7]-[10], [12]. The on-site phase-error measurement is based on a phase-retrieval method using precisely measured intensity profiles near the beam waist. A bendable mirror is placed upstream of the focusing mirror to compensate for the wavefront error due to the imperfection of the focusing devices. Details of the method [11] will be presented with the latest results achieved in collaborative research with RIKEN and JASRI of SPring-8.

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1. K. Yamauchi et al., J. Synchrotron Rad., 9 (2002), 313-316.
2. Y. Mori et al., Rev. Sci. Instr., 71 (2000), 4627-4632.
3. K. Yamauchi et al., Rev. Sci. Instr., 73 (2002), 4028-4033.
4. K. Yamauchi et al., Rev. Sci. Instr., 74 (2003), 2894-2898.
5. H. Mimura et al., Rev. Sci. Instr., 76 (2005) 045102.
6. H. Mimura et al., Appl. Phys. Lett., 90 (2007), 051903.
7. K. Yumoto et al., Rev. Sci. Instr., 77 (2006), 093107.
8. H. Mimura et al., Phys. Rev. A, 77 (2008), 015812.
9. T. Kimura et al., Jpn. J. Appl. Phys., 48 (2009) 072503.
10. S. Handa et al., Jpn. J. Appl. Phys., 48 (2009) 096507.
11. S. Handa et al., Nucl. Instr. and Meth. A, (2010) to be published.
12. H. Mimura et al., Nature phys., (2009) (published on-line).